




Jernbaneverket

# Request for Information (RFI) for the Norwegian GSM-R BSS network replacement

## Part A: Scope

1.0	N/A	04.10.2012			
<b>Revision</b>	<b>Revision history</b>	<b>Date</b>	<b>Issued by</b>	<b>Controlled by</b>	<b>Approved by</b>
<b>Title</b>  Request for Information (RFI) for the Norwegian GSM-R BSS network replacement  Part A: Scope			<b>Number of pages:</b>	16	
<b>Project:</b>			<b>Reference:</b> 201207903		<b>Revision:</b> 1.0
 <b>Jernbaneverket</b>					

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>	<b>Ref.:</b> 201207903
		<b>Date:</b> 04.10.2012
		<b>Rev.:</b> 1.0
	<b>PART A: Scope</b>	Page 2 of 16

## TABLE OF CONTENTS

1	Introduction .....	3
1.1	Project overview .....	3
1.2	JBV planning process .....	3
1.3	Project objectives .....	4
1.4	Time schedule .....	4
2	This is to be swapped .....	5
2.1	Base stations and controllers .....	5
2.2	Access Transmission network .....	6
2.3	Test network .....	7
3	Swap process .....	8
4	Respondent's delivery .....	9
4.1	Delivery of system components .....	9
4.1.1	Base stations and controllers .....	9
4.1.2	Access transmission network .....	9
4.1.3	Power supply .....	10
4.1.4	Element manager .....	10
4.1.5	Test network .....	10
4.2	Delivery of Services in the swap process .....	10
4.2.1	Project management .....	10
4.2.2	Engineering and planning .....	10
4.2.3	RAMS .....	10
4.2.4	Installation .....	10
4.2.5	Testing, commissioning and integration .....	11
4.2.6	De-installation and transportation of old equipment .....	11
4.2.7	Operation, administration and management .....	11
4.2.8	Training .....	11
4.2.9	Documentation .....	12
4.3	Delivery of Services in an operational phase .....	12
4.3.1	Support agreement .....	12
4.3.2	Spare parts .....	13
5	Pilot line - Meråkerbanen .....	14
5.1	General description of the pilot line .....	14
5.2	Sites on the pilot line .....	14
5.3	Access transmission network on the pilot line .....	14
5.4	Other considerations on the pilot line .....	14
6	Customer's deliveries .....	15
7	Not part of the scope of the project .....	15

## LIST OF FIGURES

Figure 1	Scope of the swap .....	5
Figure 2	Norwegian GSM-R network .....	6

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 3 of 16
--	--	---

## 1 INTRODUCTION

The Norwegian GSM-R network was rolled out during the period 2004 – 2007. The existing Vendor is NSN. The BSS equipment is now approaching end of life and will have to be replaced by new equipment within 2018. Since we expect that an upgrade to new radio technology will not take place until after 2020, based upon specifications from UIC and ERA, Jernbaneverket (JBV) will consider a swap to new GSM-R equipment from one of the Vendors delivering equipment to this market before end of support of existing equipment.

The intention of this RFI is to examine equipment and solutions in order to get an overview of the existing BSS market including access transmission (mainly radio relay links/microwave). Further, the intention is to obtain estimates. The estimates obtained will be applied in the budgeting process in the Master plan, and for budgetary reasons we ask for estimates within +/-20% accuracy.

There will be no element of comparison when examining the information provided. The information obtained is for the sole purpose of preparing a Master plan. See also document “Instructions”.

### 1.1 PROJECT OVERVIEW

The roll-out of the Norwegian GSM-R network started in 2004, and the first line was launched on May 15 2004. See [Figure 1 Scope of the swap](#) and [Figure 2 Norwegian GSM-R network](#).

The existing system Vendor has communicated that year 2018 is the final year with delivery of spare parts and support on the existing BSS product line. JBV is, on the basis of this information, considering replacing the entire BSS network, including access transmission, within 2018.

The standardization roadmap for railway radio access indicates that the standard in 2018 will still be GSM-R. Hence, the swap will be from GSM-R to GSM-R.

### 1.2 JBV PLANNING PROCESS

This RFI is part of the so-called “Master plan” process in JBV. All projects requiring funding must be described in a Master plan. A Master plan describes a recommended implementation plan including a budget. The Master plan will then be part of the request for funding of the project.

The estimates obtained during this RFI process will be input to the budget in the Master plan. The budget shall reflect the life cycle cost of a system, and that’s the reason why JBV is requesting estimates also for the operational period after swap.

The RFI process includes no element of evaluation; i.e. no comparison of Respondents will be done based upon the received material.

Following the Master plan is the “Detail plan”. During the Detail plan process the project is more specifically described. The procurement process is part of the Detail plan process.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 4 of 16
--	--	---

### **1.3 PROJECT OBJECTIVES**

The Master plan project shall prepare JBV for the replacement of equipment that needs to be done in the GSM-R BSS network and the access transmission network.

The Master plan shall describe alternative concepts for the replacement; technological alternatives as well as implementation scenarios. A cost estimate shall be outlined for the recommended concept.

### **1.4 TIME SCHEDULE**

The Master plan shall be finalized and approved in Q2 2013. Depending on funding, the Detail plan project will start in Q3 2013. This means that a procurement process may be carried through in 2014 with at likely issue of Request for Quotation Q2/Q3 2014. The swap itself is planned to start at the end of 2015. The length of the swap period has not been decided, but a recommendation will be outlined in the Master plan. Input from Respondents during this RFI process will be part of the basis for this decision.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 5 of 16
	<b>PART A: Scope</b>	

## 2 THIS IS TO BE SWAPPED

### 2.1 BASE STATIONS AND CONTROLLERS

Nokia Siemens Networks (NSN) is the existing Vendor for the Norwegian GSM-R network. Both the NSS and the BSS are delivered by NSN.

The entire BSS network may be swapped. The scope of the swap is shown in figure below.

Parameter	#	Description
No. of km with GSM-R coverage	3800 km	
No. of BTSs	Approx. 550	BS40 + BS240 + 30 FlexiBTS. This is the estimated number at the time of swap; the current number is 526.
No of BSCs	2 (one active + one hot standby)	FlexiBSC - SW: RG-20
No. of microwave hops	Approx. 700	SRAL-XD This is the estimated number at the time of swap; the current number is 678.

**Figure 1 Scope of the swap**

The new BSS network will be based upon the existing BTS and BSC positions; i.e. only replacement of existing equipment and associated services (installation, testing etc.) is within the scope.

For cost estimates it should be assumed that 10% of the sites are accessible by road, 10% are accessible by helicopter and 80% are accessible by maximum 500 m walking distance from road.

The default configuration of a base station is one cell distributed onto two or three antenna directions. The default capacity of such a single cell site is 2 carrier units combined into one cell. A few base stations are configured with more than one cell. All cells are configured with minimum 2 carrier units due to redundancy requirements.

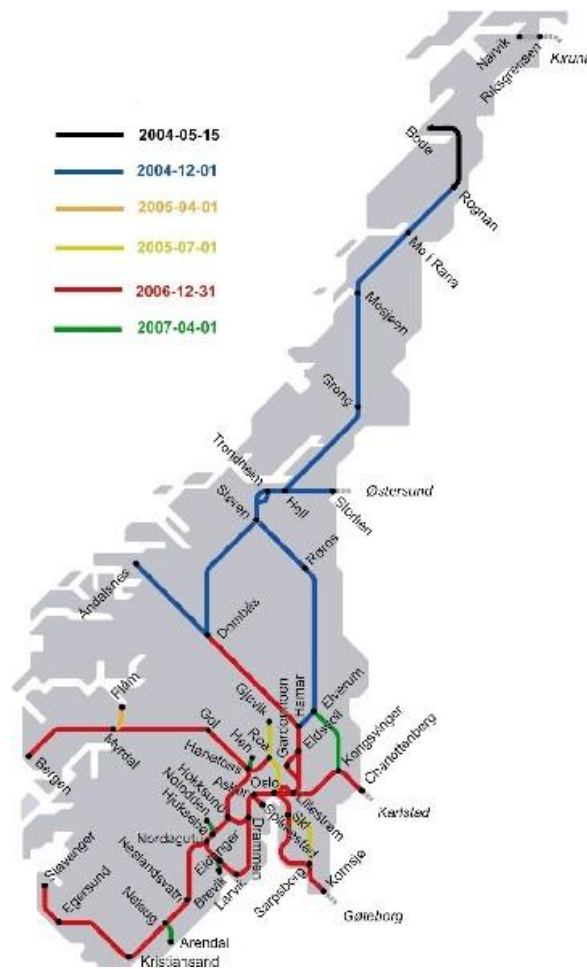
The feeders are one Rx and one Tx/Rx with splitters mounted near the antennas.

The network is configured with standard GSM-R functionality.

Please see Figure 2 Norwegian GSM-R network showing the extent of the Norwegian GSM-R network.

There are two BSC/ TRAU clusters which are connected in a master and hot-standby configuration so that if a fault occurs in one BSC the other BSC takes over immediately.

The Norwegian network supports GPRS.



**Figure 2 Norwegian GSM-R network**

## 2.2 ACCESS TRANSMISSION NETWORK

All existing radio relay systems connecting GSM-R base stations may be swapped. The total number of radio relay hops to be swapped is approximately 700.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 7 of 16
--	--	---

There are relay sites between some of the base station sites in order to obtain line of sight. Hence the total number of radio relay systems to be swapped is higher than the number of base stations.

To ensure good availability of the BTSs in the present network, up to 5 BTSs are clustered together in a 2Mbps loop which can be fed from both ends in case of single faults in the transmission. In this loop there are typically 8x2Mbps links available, however, only one link is connected through to the BSCs in each end to complete the loop. In case of a transmission fault in the loop the BTSs will be fed from the opposite side if necessary so that no significant interruption in transmission will occur.

Some transmission is done over fiber or pseudo-wire over IP/MPLS and is not subject to swap.

JBV holds licenses within the following frequency bands: 18 GHz, 26 GHz and 38 GHz. A few single licenses have been awarded in the 7 GHz band.

### **2.3 TEST NETWORK**

JBV has a test network configured with at least one piece of equipment from all systems represented in the live network. The main purpose of this network is to verify all changes planned before implementation in the live network. This includes changes in software, hardware and configurations.

The current test network contains two base stations, one controller and one radio relay system that are replica of the live network equipment.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 8 of 16
--	--	---

### 3 SWAP PROCESS

The swap process focuses on swapping both the BSS network as well as the access transmission (radio relay links) in the complete GSM-R network. The main focus is on safety and minimum disturbances in the network.

The swap will be performed in a live network, and outage is not allowed when trains are passing. It is therefore vital to keep outage time in the network to an absolute minimum.

The object is to swap all BSS equipment (BSCs, TRAU's and BTSs) (not including rectifiers, batteries, antennas and feeders) as well as the access transmission, including both ODU/ antenna and IDU. To maintain the redundancy in transmission it may be an advantage to swap all transmission in a loop (5 BTSs) either before or after swapping the BTSs.

Before starting the swap, a small section of a line shall be selected for a pilot. This area shall be thoroughly optimized and tested before starting to swap the remaining areas.

The network should be swapped area by area and both before and after the swap. Each area shall be logged with respect to call set-up and handover performance. The network will be approved area by area when the network performance after the swap is equal to or better than it was before.

It is assumed that the new access transmission network will be built in parallel with and independent of the existing links, and unless there are locations where there is no room for additional antennas, both links will be in operation with full redundancy during the BSS swap.

It is further assumed that in most cases the new BTS can be installed and tested at site next to the existing BTS. Since no RF equipment shall be swapped, this swap would mainly consist in swapping the jumper cables from one BTS to the other, alternatively replacing the jumper cables in case of different connectors. This swap should in general give an outage time of less than **5min**.

In case there is not space enough to place the new BTS next to the existing BTS, reallocation of equipment will have to be performed before the new BTS will be in operation. In this case an outage time of **15min** can be accepted.

The outage times will be particularly important in areas with a high train-density (e.g. Oslo). And it will always be important to perform the swap within a preplanned service-window.

JBV assumes that there will be several teams working in parallel and on different lines. However, in order to minimize risk and maintain control of the process, only one swap at a time will be allowed.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 9 of 16
--	--	---

## **4 RESPONDENT'S DELIVERY**

JBV will request a turn-key delivery for this swap. This means that the chosen Vendor has a total responsibility for carrying through the swap process including all project management and interface coordination; also towards the JBV deliveries. The Vendor will take full responsibility for a successful swap. However, detailed progress plans will be discussed in regular meetings with JBV.

By swap is meant that the existing BTSs as well as the existing radio relay access systems are replaced

This chapter first describes the delivery of system components and then the delivery of services related to the swap process as well as services during an operational phase.

Finally a model network is described.

All deliveries described shall be indicatively priced in Appendix B.

### **4.1 DELIVERY OF SYSTEM COMPONENTS**

#### **4.1.1 BASE STATIONS AND CONTROLLERS**

The delivered system shall be flexible and easy to expand. Preferably the design is modular.

The base station swap shall be one to one.

The capacity of each BTS shall remain unchanged. The configuration shall be as close to the existing as possible. The database shall be configured with a dataset to be approved by JBV.

The quality of the radio network shall be equal to or better than the original. Quality will be measured by call success rate, handover success rate and dropped call rate. In addition the coverage shall be as close to the original as possible. This will be verified by coverage measurements; see 4.2.5

The number of base station controllers as well as configuration shall be planned by Respondent and be based upon the capacity and redundancy concept of his controllers. The new configuration shall reflect the current configuration with respect to availability.

No RF equipment/ cables shall be swapped. Depending on the connectors on the BTSs, jumper cables may have to be swapped.

#### **4.1.2 ACCESS TRANSMISSION NETWORK**

All existing radio relay systems shall be swapped. The new system may either be stand-alone or it may be integrated with the base station. The system shall include new cabling and antennas.

New systems shall be configured with frequencies within bands for which JBV holds licenses.

The new radio relay systems shall preferably be either IP or a combination of TDMA and IP.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 10 of 16
--	--	--

The system should also preferably be compatible to JBV's existing IP/MPLS network based on Alcatel Service Routers.

#### **4.1.3 POWER SUPPLY**

All sites have 8 hours backup provided and are equipped with rectifiers and batteries. This is Customer's delivery. It's assumed that Respondent's equipment is DC fed (-48V).

#### **4.1.4 ELEMENT MANAGER**

All new system components shall be delivered with relevant element managers enabling Fault Management (FM), Configuration Management (CM) and statistics for the entire BSS and access transmission network. The element managers shall be integrated towards JBV's top level network management system TeMIP by Hewlett Packard. The northbound interface to TeMIP may be any protocol supported by the access module of TeMIP. The Respondent is required to deliver necessary documents to Hewlett Packard to develop the access module or deliver the access module himself.

#### **4.1.5 TEST NETWORK**

The test network shall be configured with two base stations, one controller/ TRAU and one radio relay system being replica of the components in the swapped BSS network.

### **4.2 DELIVERY OF SERVICES IN THE SWAP PROCESS**

#### **4.2.1 PROJECT MANAGEMENT**

It is assumed that the indicative pricing includes estimates for a complete delivery including services such as project management and necessary project control including interface coordination towards JBV's deliveries. The Respondent shall take full turn-key responsibility.

#### **4.2.2 ENGINEERING AND PLANNING**

The Respondent shall estimate cost for any engineering and planning that needs to be performed as a preparation for the swap.

#### **4.2.3 RAMS**

##### **4.2.3.1 RAM**

All RAM activities required by EN 50126 must be seen as a part of the delivery. As part of the delivery the Respondent must be prepared to deliver all documentation stated in EN 50126, including any reliability and availability calculations additionally required by JBV.

##### **4.2.3.2 SAFETY**

All safety activities required by EN 50126 must be seen as a part of a delivery. As part of a delivery the Respondent must be prepared to provide all documentation stated in EN 50126, including any safety calculations and analysis additionally required by JBV after EN 50126 chapter 6 phase 3.

Safety cases for system and/or sub system is to be structured according to EN 50129.

#### **4.2.4 INSTALLATION**

The delivery includes all necessary installation, warehouse and transportation activities.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 11 of 16
--	--	--

The swaps will be performed in a live network and hence no swap will be allowed when trains are passing. A proposed time schedule for each area (5 sites) shall be given to JBV no later than one week prior to the swap-start in the area, and a final confirmation will be given 24 hours prior to the swap.

#### **4.2.5 TESTING, COMMISSIONING AND INTEGRATION**

The delivery includes all testing, commissioning and integration activities. JBV shall have the right to witness these activities.

Test specifications and test protocols shall be prepared by the Respondent and approved by JBV.

Commissioning and integration procedures shall also be prepared by the Respondent and approved by JBV.

Respondent shall estimate cost according to their own testing regime that are normally applied on such processes. However, below some specifically required tests are described.

Respondent shall carry out coverage measurements before and after swap in order to verify that coverage levels are maintained and in particular that cell borders are unchanged. This is of high importance because Tunnel Master Units are tuned for a specific input signal level. Further, the backup system for location dependent addressing is based upon radio cell. If measurements show major deviations from the original coverage; tuning shall be performed and a new coverage measurements shall be carried out at no extra cost.

BTS feeder cables and antennas shall not be part of the swap. Respondent shall however carry out measurements of existing cabling and antenna system to which the new base station shall be connected. These measurements shall verify that there are no major losses in the antenna and cabling system.

A stability test shall be done during the warranty period where agreed levels of certain Key Performance Indicators (KPIs) are monitored.

JBV's acceptance of the swap delivery will partly be based upon acceptance of test results.

#### **4.2.6 DE-INSTALLATION AND TRANSPORTATION OF OLD EQUIPMENT**

The Respondent will be responsible for de-installing all existing equipment and transporting it to assigned collection points. (Note however that disposal is customer's responsibility and not within the Respondent's scope.)

#### **4.2.7 OPERATION, ADMINISTRATION AND MANAGEMENT**

Respondent is responsible for all work related to initial configuration and management of OAM systems for the new system equipment.

#### **4.2.8 TRAINING**

We ask the Respondent to estimate cost for the following types of courses:

- System overview

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 12 of 16
	<b>PART A: Scope</b>	

- System engineer
- 1<sup>st</sup> line support training

All necessary resources for training shall be included in the course fee and shall include as a minimum:

- Instruction
- Training facilities
- Teaching material
- Equipment for practical training
- Training documentation
- Travel and accommodation expenses, allowance, etc. for instructors.

#### **4.2.9 DOCUMENTATION**

Respondent is responsible for all documentation of the swap and shall indicate a cost for this.

Documentation includes as a minimum:

- Vendor-standardised product specific documents
- Project specific technical documentation
  - Development, design and customization documentation
  - System specific documentation
  - Site specific documentation
  - Inventory documentation
  - Environmental documentation
- Project acceptance documentation
  - Test plans
  - Test procedures
  - Test protocols
- User manuals
- Project management documentation
- OAM documentation
  - Operating instructions
  - Installation procedures
  - Maintenance instructions
- Training documentation
- Safety documentation needed for the application to the Norwegian Railway Inspectorate

#### **4.3 DELIVERY OF SERVICES IN AN OPERATIONAL PHASE**

JBV's existing network is maintained by an in-house 1<sup>st</sup> line support organization. This organization will also perform the 1<sup>st</sup> line support for the swapped network.

##### **4.3.1 SUPPORT AGREEMENT**

Respondent shall price a support contract. This includes as a minimum:

- 2<sup>nd</sup> line support:
  - Local competence centre in Norway which is JBV's single point of contact
  - Provide 24/7 emergency standby

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 13 of 16
--	--	--

- Support and inform JBV's 1<sup>st</sup> line support team
  - Record and complete fault reports
  - Locate malfunction and perform preliminary diagnostics
  - Process and track fault reports
  - Support commissioning and test bed acceptance as required
  - Perform customisation of acceptance and upgrade procedures
- 3rd line support:
    - Respondent shall have a central service office that provides expert services and interacts as interface to our development department in case of software defects or change requests. The central service centre will be involved by the local competence centre in Norway in case a problem cannot be solved locally.

JBV will assign priority levels to problems. There will be different reaction times required for problems of different priority.

#### **4.3.2 SPARE PARTS**

Respondent shall price spare parts for the new system equipment. These spare parts are to be stored by JBV who are handling the 1<sup>st</sup> line support. Respondent shall estimate the amount of spare parts needed.

There are 6 spare part pools evenly distributed along the rail network.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>  <b>PART A: Scope</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0 Page 14 of 16
--	--	--

## **5 PILOT LINE - MERÅKERBANEN**

JBV would like the Respondents to provide estimates for the swap of a model network. JBV is considering performing the first swap on a pilot line. The proposed pilot line is the model network to be indicatively priced in this RFI.

See site list in Attachment 1 in Part D Attachments for detailed information per site.

### **5.1 GENERAL DESCRIPTION OF THE PILOT LINE**

The pilot line includes 10 BTSs configured in two loops containing 5 BTSs each. All the 10 sites are connected by PDH microwave hops containing 8xEI. All sites apart from one are connected in series without protection. One site is connected as a branch (tail) site. This hop is protected.

The first site is connected to a router by a microwave hop. The other end is connected directly to a router. The routers are connected to a “transmission box” in Trondheim routing transmission the opposite direction in the loop in case of transmission fault.

Each BTS contains 2 TRXs combined into one cell. This cell is split into two sectors on nine of the sites. On one site the cell is split into three sectors. There is a maximum of 8 environmental alarms (closed loop) connected on each site. The element manager for both BSS and microwave is located in Trondheim.

The replacement shall be one to one; i.e. no change in configurations shall be done.

### **5.2 SITES ON THE PILOT LINE**

All the sites except one are located in greenfield sites with a small cabin and a mast. It can be assumed that there is sufficient room inside the cabin to mount both the new BTS and microwave link next to the existing equipment. The non-greenfield site is located in the “communication room” at the railway station at Teveldalen station. Also on this site there is a mast.

See Attachment 1 for description of accessibility.

### **5.3 ACCESS TRANSMISSION NETWORK ON THE PILOT LINE**

All microwave hops are co-located with the BTSs. See Attachment 2 for description of microwave layout.

See Attachment 3 for microwave configuration.

The links should either be IP based or be of hybrid type.

All BTSs shall be synchronised over the microwave link

### **5.4 OTHER CONSIDERATIONS ON THE PILOT LINE**

48V DC with battery backup is available on all sites.

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0
	<b>PART A: Scope</b>	Page 15 of 16

## **6 CUSTOMER'S DELIVERIES**

The following will be delivered to the project by the customer, JBV:

- Communication towards the Norwegian Railway Inspectorate. Note however that the safety documentation will be handled by the Respondent.
- Assistance from the GSM-R customer care center in order to handle communication towards Train Control Centres (TCCs) for coordination of downtime periods during the swap
- Assistance from the GSM-R network supervision center during integration
- Mains power delivery on site
- 48 V DC on site
- Battery backup system on site
- Disposal of old equipment. Note however that de-installation and transportation to designated collection points is part of Respondent's responsibility.

## **7 NOT PART OF THE SCOPE OF THE PROJECT**

The following is not part of the scope of this project:

- Tunnel systems
- On-board equipment and other radio terminals
- Base station antennas and cabling
- Cabins/shelters
- Masts

	<b>Request for information (RFI) for the Norwegian GSM-R BSS network replacement</b>	<b>Ref.:</b> 201207903 <b>Date:</b> 04.10.2012 <b>Rev.:</b> 1.0
	<b>PART A: Scope</b>	Page 16 of 16

## REFERENCES

1. Requirements for the Norwegian railway infrastructure  
“Teknisk regelverk” - only available in Norwegian at  
<http://www.jernbaneverket.no/no/Marked/Leverandorinfo/Teknisk-regelverk/>